KEITHLEY das

SOFT500 SOFTWARE SYSTEM PROGRAMMING REFERENCE GUIDE

FOR THE IBM PC AND PC-XT

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INTRODUCTION

This guide is designed as a supplement to the larger volume of documentation you received with your Soft500 software. In these pages you will find an alphabetized list of all Soft500 commands and their parameters, along with descriptions of each parameter.In addition, sample programs and useful reference tables are provided.

Commands are listed alphabetically. The parameters enclosed by square brackets are optional. Two parameters separated by the word "or" signifies that one, but not both, of the parameters must be included in the parameter list. An ellipsis (...) indicates that more than one parameter of the same form may be used.

ANIN — Analog Input

CALL ANIN' (ARN$, SN, IONL$, BINTV% [,CY%] [,TM$] [,BFN$])

ARN$ - Array Name (string,input): Up to 8 significant characters plus type declarer, no delimiters.
SN - Sample Number (real,input): Minimum legal value is 1.
IONL$ - Input/Output Name List (string,input): List of 1 to 64 ionames; specifies channels sampled.
BINTV% - Background Interval (integer,input): Specifies sampling rate in terms of interrupt period.
CY% - Cycling (integer,input): Valid integers are 1 to 32767, and -1 (task cycles indefinitely).
TM$ - Trigger Mode (string,input): Valid strings for ANIN are "WBT", "WGO", "BT".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Samples up to 64 channels of analog input / Background / Supports all AIM modules

Timing

(in milliseconds)
Formula: 0.662 ms + (n * 0.191 ms)
where n = number of channels accessed.

Chs	Time	Chs	Time	Chs	Time	Chs	Time
1	0.526	5	1.290	9	2.054	13	2.818
2	0.717	6	1.481	10	2.245	14	3.009
3	0.908	7	1.672	11	2.436	15	3.199
4	1.099	8	1.863	12	2.627	16	3.391

Table assumes AIM1, 2, or 3 with gain of x1,x10, or x100.
Gain of x1000: add 0.060 ms/ch
AIM4 or AIM5: add 2.481 ms/ch
AIM6: add 0.281 ms/ch

ANINQ — Analog Input Quick

CALL ANINQ' (ARN$, SN, IONL$, SINTV% [,TM$])

ARN$ - Array Name (string,input): Up to 8 significant characters plus type declarer, no delimiters.
SN - Sample Number (real,input): Minimum legal value is 1.
IONL$ - Input/Output Name List (string,input): List of 1 to 64 ionames; specifies channels sampled.
SINTV% - Singleground Interval (integer,input): Legal values are 1 to 6400 and 0 (single channel only).
TM$ - Trigger Mode (string,input): Valid string for ANINQ is "WST".

Notes

Samples up to 64 channels of analog input at high speed / Singleground / Supports AIM1, AIM2, and AIM3 modules

Timing

(in milliseconds)
Single channel: max 31.8 **usec** per conversion (or 31.4 KHz) when SINTV% = 0.
Multi-channel: Formula: (0.17ms × n) + 0.16ms = SI or (SINTV% × 10) where n=# of chs acessed and SI = minimum interval of time between samples.

Chs	Time	Chs	Time	Chs	Time	Chs	Time
1	.330	5	1.010	9	1.690	13	2.370
2	.500	6	1.180	10	1.860	14	2.540
3	.670	7	1.350	11	2.030	15	2.710
4	.840	8	1.520	12	2.200	16	2.880

Example: For 4 chs: (0.170 * 4) + 0.160 = .840
SINTV% is assigned the value of 84, (.840 * 10) = 84.

ANOUT — Analog Output

CALL ANOUT' (ARN$, IONL$, BINTV% [,CY%] [,TM$] [,BFN$])

ARN$ - Array Name (string,input): Name of Soft500 array to be accessed.
IONL$ - Input/Output Name List (string,input): List of 1 - 64 ionames, specifies channels to be output.
BINTV% - Background Interval (integer,input): Specifies output rate in terms of interrupt period.
CY% - Cycling (integer,input): Valid integers are 1 to 32767, and -1 (task cycles indefinitely).
TM$ - Trigger Mode (string,input): Valid strings for ANOUT are "WBT", "WGO", "BT".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Outputs analog values to up to 64 channels / Background / Supports all AOM modules

Timing

(in milliseconds)
Formula: 0.680 ms + (n * 0.047 ms)
where n = number of channels output.

Chs	Time	Chs	Time	Chs	Time	Chs	Time
1	0.400	5	0.588	9	0.776	13	0.964
2	0.447	6	0.635	10	0.823	14	1.011
3	0.493	7	0.682	11	0.870	15	1.058
4	0.541	8	0.729	12	0.917	16	1.105

ANREAD — Analog Read

CALL ANREAD' (ION$, VA [,EUF%] [,TM$])

ION$ - Input/Output Name (string,input): Name of channel read; channel named previously with IONAME.
VA - Value (real,output): Returned as raw value, voltage, or engineering unit as specified by EUF%.
EUF% - Engineering Units Flag (integer,input): See page 48.
TM$ - Trigger Mode (string,input): Valid string for ANREAD is "WST".

Notes
Samples a single channel of analog input / Foreground or Singleground / Supports all AIM modules

Timing
Execution time to read raw values: 36 ms
Execution time to read volts: 60ms

ANWRITE — Analog Write

CALL ANWRITE' (ION$, VA [,EUF%] [,TM$])

ION$ - Input/Output Name (string,input): Name of channel to be written to; channel named with IONAME.
VA - Value (real,input): Specified as raw value or voltage depending on EUF% value.
EUF% - Engineering Units Flag (integer,input): See page 48.
TM$ - Trigger Mode (string,input): Valid string for ANWRITE is "WST".

Notes

Writes a specified value to a channel of analog output / Foreground or Singleground / Single channel / Supports all AOM modules

Timing

Execution time to read raw values: 31 ms
Execution time to read volts: 39 ms

ARDEL — Array Delete

CALL ARDEL' (ARN$)

ARN$ - Array Name (string,input): Name of Soft500 array to be deleted.

Notes
Deletes a Soft500 array from Soft500 memory / Foreground

ARGETVAL — Array Get Value

CALL ARGETVAL' (ARN$, DEP, WID% or ION$, VA [,EUF%])

ARN$ - Array Name (string,input): Name of Soft500 array to be accessed.
DEP - Depth (real,input): Range of legal values determined by the depth of the array accessed.
WID% - Width (integer,input): Range of legal values determined by the width of the array accessed.
ION$ - Input/Output Name (string,input): Specifies width when accessing arrays made with an ioname list.
VA - Value (real,output): Returned in terms of volts or engineering units as specified by EUF%.
EUF% - Engineering Units Flag (integer,input): See page 48.

Notes
Retrieves a value stored in a Soft500 array / Foreground

Timing
To retrieve values from a Soft500 word array:
Raw Binary: 44 ms
Volts: 52 ms
Type K Thermocouple: 250 ms

ARLABEL — Array Label

CALL ARLABEL' (ARN$, LAB$)

ARN$ - Array Name (string,input). Name of Soft500 array to be labeled.
LAB$ - Label (string,input/output). May be 1 to 255 characters in length.

Notes

Associates a descriptive string with a Soft500 array / Foreground / Label will be retained when array is saved to disk

ARLASTP

Array Last Point

CALL ARLASTP' (ARN$, LP)

ARN$	Array Name (string,input): Name of Soft500 array currently in memory
LP	Last Point (real,output): Depth index of last point accessed by a Soft500 background routine.

Notes

Returns the depth index of the last point accessed by Soft500 background routine. Foreground /
Used with arrays accessed by ANIN, ANINQ, ANOUT, DIGIN, DIGOUT, FREQIN

ARLOAD — Array Load

CALL ARLOAD' (ARN$, FN$)

ARN$ Array Name (string,output): Returns the name of the Soft500 array being loaded.
FN$ File Name (string,input): DOS filename of array to be loaded.

Notes

Loads a Soft500 array from disk into Soft500 memory / Singleground / Cannot be executed when interrupts are on / ARN$ should be initialized to at least nine characters

Disk Access Timing

Array size (bytes)	Hard Disk	Floppy disk	Array size	Hard disk	Floppy disk
20	132 ms	1.041 sec	60,000	1.154 sec	4.380 sec
2,000	305 ms	1.564 sec	100,000	1.728 sec	7.427 sec
10,000	411 ms	1.952 sec	200,000	3.402 sec	12.500 sec
20,000	551 ms	2.443 sec	300,000	4.818 sec	18.430 sec
40,000	829 ms	3.391 sec			

ARMAKE

Array Make

CALL ARMAKE' (ARN$, DEP, WID% or IONL$)

ARN$ - Array Name (string,input): Up to 8 significant characters plus type declarer, no delimiters.
DEP - Depth (real,input or output): Minimum legal value is 1, max. value depends on memory available.
WID% - Width (integer,input): Legal values range from 1 to 32767
IONL$ - Input Output Name List (string,input): List of 1 to 60 analog output channels

Notes

Creates a Soft500 array / Foreground / Array type declarers include: &-bit array, @-byte array, %-word array, ! (or no declarer) single precision real array. If IONL$ is used, array must be a word array

ARPUTVAL — Array Put Value

CALL ARPUTVAL' (ARN$, DEP, WID% or ION$, VA [,EUF%])

ARN$	Array Name (string,input) Name of Soft500 array to be accessed.
DEP	Depth (real,input) Range of legal values determined by the depth of the array accessed.
WID%	Width (integer,input) Range of legal values determined by the width of the array accessed.
ION$	Input Output Name (string,input) Specifies width when accessing arrays made with an ioname list.
VA	Value (real output) Returned as raw value, voltage, or engineering units as specified by EUF%.
EUF%	Engineering Units Flag (integer,input) See page 48.

Notes

Stores value in Soft500 array at specified depth and width indices / Foreground

Timing

To store values in a Soft500 word array:
Raw binary: 44 ms
Volts: 52 ms

ARSAVE

Array Save

CALL ARSAVE' (ARN$, FN$)

ARN$ - Array Name (string,input): Must refer to a Soft500 array currently in memory.
FN$ - File Name (string, input): Assigns standard DOS filename to the array.

Notes

Saves a Soft500 array on floppy or hard disk / Singleground / Interrupts must be disabled before executing ARSAVE

Disk Access Timing

Array Size (bytes)	Hard disk	Floppy disk
20	132 ms	1.041 sec
2,000	305 ms	1.564 sec
10,000	411 ms	1.952 sec
20,000	551 ms	2.443 sec
40,000	829 ms	3.391 sec

Array size	Hard disk	Floppy disk
60,000	1.154 sec	4.380 sec
100,000	1.728 sec	7.427 sec
200,000	3.402 sec	12.500 sec
300,000	4.818 sec	18.430 sec

ARSEG — Array Segment

CALL ARSEG' (ARN$, ASEG)

ARN$ - Array Name (string,input) Name of Soft500 array to be accessed
ASEG - Array Segment (real,output): Segment address of the first byte of data in the specified array.

Notes

Returns the segment address of the first byte of a Soft500 array / Foreground / Used when accessing arrays through BASIC's PEEK and POKE commands

Timing

To store values in Soft500 word array:
Raw binary:5 ms *
Volts: N/A
*Using 2 POKES per element.
no calculations involved

To retrieve values from a Soft500 word array:
Raw binary: 7 ms **
Volts: N/A
**Using the formula X = PEEK(I) + (256 * PEEK(I + 1))

ARSTATUS — Array Status

CALL ARSTATUS' (ARN$, DEP, WID% [,LP] [,LAB$])

ARN$	Array Name (string,input): Name of Soft500 array currently in memory.
DEP	Depth (real,output): Depth of the array
WID%	Width (integer,output): Width of the array
LP	Last Point (real,output): Depth of last point accessed by a Soft500 background routine.
LAB$	Label (string,output): Descriptive label associated with the array

Notes

Returns information about a given Soft500 array / Foreground

BACKCLEAR — Background Clear

CALL BACKCLEAR (no parameters)

Notes

Clears all current background tasks / Foreground

BACKTIME — Background Time

CALL BACKTIME' (TIME)

TIME - Time (real,output): Amount of time (in milliseconds) taken by all background routines.

Notes

Measures interval between an interrupt request and the return to foreground execution / Foreground

CLOCKREAD — Clock Read

CALL CLOCKREAD' (HR%, MIN%, SEC% [,DATE%, MO%, YR%] [,TM$ [,BFN$]])

HR% - Hour (integer,output): Hour value of time of day.
MIN% - Minutes (integer,output): Minute value of time of day.
SEC% - Second (integer,output): Seconds value of time of day.
DATE% - Date (integer,output): Day of the month.
MO% - Month (integer,output): Values returned correspond to months such that 1=January, 2=February.
YR% - Year (integer,output): Last two digits of the current year.
TM$ - Trigger Mode (string,input): Valid strings for CLOCKREAD are "WBT", "WGO".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Accesses the Series 500 real-time clock / Foreground or background / Clock may be set by running the "SETCLOCK" program included on the Soft500 disk.

COUNTERREAD

Counter Read

CALL COUNTERREAD' (ION$, COUNT# [,TM$ [,BFN$]])

ION$ - Ioname (string, input): Specifies channel count to be read; must be the same name as used by PULSECOUNT.
COUNT# - Count (Double Precision Real,output): Current pulse count on counters initialized by PULSECOUNT.
TM$ - Trigger Mode (string,input): Valid strings for COUNTERREAD are "WBT", "WGO".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Reads the count initiated by the PULSECOUNT command / Foreground or background / Supports PIM1 module

CALL DERIVATIVE' (ARN$, DEP, WID%, DERIV [,EUF%])

ARN$ Array Name (string,input): Name of Soft500 array to be accessed.
DEP - Depth (real,input): Range of legal values determined by the depth of the array accessed.
WID% Width (integer,input): Range of legal values determined by width of array accessed.
DERIV Derivative (real,output): Slope of the data curve at point specified.
EUF% - Engineering Units Flag (integer,input): See page 48.

Notes

Returns the slope of a set of data at a particular point / Foreground

DIGIN

Digital Input

CALL DIGIN' (ARN$, SN, IONL$, BINTV% [,CY%] [,TM$] [,BFN$])

ARN$ - Array Name (string,input): Up to 8 significant characters plus type declarer, no delimiters.
SN - Sample Number (real,input): Min. value is 1, Max. value depends on amount of free memory.
IONL$ - Input/Output Name List (string,input): List of 1 to 64 ionames, specifies channels sampled.
BINTV% - Background Interval (integer,input): Specifies sampling rate in terms of interrupt period.
CY% - Cycling (integer,input): Valid integers are 1 to 32767, and -1 (task cycles indefinitely).
TM$ - Trigger Mode (string,input): Valid strings for DIGIN are "WBT", "WGO", "BT".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Reads up to 64 channels or ports of digital input * Background * Array created must be a bit (&) or byte (@) * Supports DIM1 and PCM2 (when configured for power input)

Timing

(in milliseconds)

CHANNELS accessed: 0.686 ms + (n * 0.045 ms)
where n = number of channels accessed.

Chs	Time	Chs	Time	Chs	Time	Chs	Time
1	0.404	5	0.584	9	0.764	13	0.944
2	0.449	6	0.629	10	0.809	14	0.989
3	0.493	7	0.674	11	0.854	15	1.034
4	0.539	8	0.719	12	0.899	16	1.079

PORTS accessed: 0.685 ms + (n * 0.043 ms)
where n = number of ports accessed.

Pts	Time	Pts	Time	Pts	Time	Pts	Time
1	0.401	5	0.573	9	0.745	13	0.917
2	0.444	6	0.616	10	0.788	14	0.960
3	0.487	7	0.659	11	0.831	15	1.003
4	0.530	8	0.702	12	0.874	16	1.046

DIGINTRIG — Digital Input Trigger

CALL DIGINTRIG' (ION$, CHM$ or PV% [,TM$ [,BFN$]])

ION$ - Input Output Name (string,input): Name of channel or port to be monitored; channel named with IONAME.
CHM$ - Change Mode (string,input): Specifies triggering condition of monitored signal, valid strings are "ON" and "OFF"
PV% - Port Value (integer,input): Legal decimal values 0-255 (when value is converted to 8-bit binary number, the status of each bit represents status of one of 8 channels)
TM$ - Trigger Mode (string,input): Valid strings for DIGINTRIG are "ST", "BT".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Triggers background, foreground or singleground routines / Single channel or port / Supports DIM1 and PCM2 (when configured for power input)

Timing

Background trigger time: 0.207 ms
Time between threshold detection and initiation of triggered task: 136 usec (approx)
Singleground trigger polling speed: 16^9 usec (approx)
Time between threshold detection and initiation of triggered task: 1.621 ms

DIGOUT — Digital Output

CALL DIGOUT' (ARN$, IONL$, BINTV% [,CY%] [,TM$] [,BFN$])

ARN$ — Array Name (string,input): Name of a Soft500 bit or byte array currently in memory.
IONL$ — Input Output Name List (string,input). List of 1 - 64 ionames; specifies channels to be output.
BINTV% — Background Interval (integer,input): Specifies output rate in terms of interrupt period.
CY% — Cycling (integer,input): Valid integers are 1 to 32767, and -1 (task cycles indefinitely).
TM$ — Trigger Mode (string,input): Valid strings for DIGOUT are "WBT", "WGO", "BT".
BFN$ — Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Outputs digital values from a Soft500 array to up to 64 digital channels or ports / Supports DOM1, PCM1, or PCM2 (when configured for power output)

Timing

(in milliseconds)

CHANNELS output: 0.680 ms + (n * 0.061 ms)
where n = number of channels output.

Chs	Time	Chs	Time	Chs	Time	Chs	Time
1	0.413	5	0.657	9	0.901	13	1.145
2	0.474	6	0.718	10	0.962	14	1.206
3	0.535	7	0.779	11	1.023	15	1.267
4	0.596	8	0.840	12	1.084	16	1.328

PORTS output: 0.678 ms + (n * 0.061 ms)
where n = number of ports output.

Pts	Time	Pts	Time	Pts	Time	Pts	Time
1	0.412	5	0.656	9	0.900	13	1.144
2	0.473	6	0.717	10	0.961	14	1.205
3	0.534	7	0.778	11	1.021	15	1.266
4	0.595	8	0.839	12	1.083	16	1.327

DIGREAD — Digital Read

CALL DIGREAD' (ION$, VA [,TM$])

ION$ - Input/Output Name (string,input): Name of channel read; channel named previously with IONAME.
VA - Value (real,output): Returns value directly to a BASIC variable.
TM$ - Trigger Mode (string,input): Valid string for DIGREAD is "WST".

Notes

Reads a single channel or port of digital input / Foreground or Singleground / Supports DIM1 and PCM2 (when configured for power input)

Timing

Foreground I/O command execution time: 30 ms

DIGWRITE — Digital Write

CALL DIGWRITE' (ION$, VA [,TM$])

ION$ - Input/Output Name (string,input): Name of channel to be output; named previously with IONAME
VA - Value (real,input): Must be 0 or 1 when writing to single channel, 0-255 when writing to port.
TM$ - Trigger Mode (string,input): Valid string for DIGWRITE is "WST".

Notes

Writes a specified value to a single channel or port / Foreground or Singleground / Supports DOM1, PCM1, and PCM2 (when configured for power output)

Timing

Foreground I/O command execution time: 30 ms

FREQIN — Frequency Input

CALL FREQIN' (ARN$, SN, ION$, BINTV%, RANGE% [,CY%] [,TM$ [,BFN$]])

ARN$ - Array Name (string,input): Up to 8 significant characters plus type declarer (%), no delimiters.
SN - Sample Number (real,input): Minimum legal value is 1.
ION$ - Input/Output Name (string,input): Name of channel to be accessed; named previously with IONAME.
BINTV% - Background Interval (integer,input): Specifies sampling rate in terms of interrupt period.
RANGE% - Range (integer,input): Specifies maximum frequency expected from input channel; see below.
CY% - Cycling (integer,input): Valid integers are 1 to 32767, and -1 (task cycles indefinitely).
TM$ - Trigger Mode (string,input): Valid strings for FREQIN are "WBT", "WGO", "BT".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Samples a single channel of frequency input / Background / Supports PIM1 module / Array created must be specified as word array (%)

RANGE% Values for Frequency Measurement:

Value	Max Frequency	Gate Time	Resolution	Value	Max Frequency	Gate Time	Resolution
1	62.5 KHz	1048.576 ms	1.0 Hz	5	1.0 mHz	65.536 ms	15.0 Hz
2	125.0 KHz	524.288 ms	1.9 Hz	6	2.0 mHz	32.768 ms	30.0 Hz
3	250.0 KHz	262.144 ms	3.7 Hz	7	4.0 mHz	16.384 ms	61.0 Hz
4	500.0 KHz	131.072 ms	7.5 Hz	8	8.0 mHz	8.192 ms	122.0 Hz

FREQREAD — Frequency Read

CALL FREQREAD' (ION$, RANGE%, FREQ [,EUF%] [,TM$])

ION$ - Input/Output Name (string,input): Name of channel accessed; channel named previously with IONAME.
FREQ - Frequency Reading (real,output): Returns frequency as raw value or hertz, as specified by EUF%.
RANGE% - Range (integer,input): Maximum frequency expected from input channel, see below.
EUF% - Engineering Units Flag (integer,input): See page 48.
TM$ - Trigger Mode (string,input): Valid string for FREQREAD is "WST".

Notes

Performs a single reading of frequency input / Foreground / Supports PIM1 module

RANGE% Values for Frequency Measurement:

Value	Max Frequency	Gate Time	Resolution	Value	Max Frequency	Gate Time	Resolution
1	62.5 kHz	1048.576 ms	1.0 Hz	5	1.0 mHz	65.536 ms	15.0 Hz
2	125.0 kHz	524.288 ms	1.9 Hz	6	2.0 mHz	32.768 ms	30.0 Hz
3	250.0 kHz	262.144 ms	3.7 Hz	7	4.0 mHz	16.384 ms	61.0 Hz
4	500.0 kHz	131.072 ms	7.5 Hz	8	8.0 mHz	8.192 ms	122.0 Hz

CALL GO ['(TM$ [,BFN$])]

TM$ - Trigger Mode (string,input): Valid string for GO is "WBT".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Triggers up to 16 background routines that have been assigned the trigger mode "WGO"

CALL GRAPH' (ARN$, WIDL$, COLL$, DISPLM$, MINY, MAXY [,MRM$, RES%] [,DEP1, DEP2] [,EUF%])

ARN$ - Array Name (string,input): Name of Soft500 array currently in memory.
WIDL$ - Width List (string,input): String consisting of widths to be graphed, for example: "1,3,5"
COLL$ - Color List (string,input): Legal values are any integer from 0-3, see page 50.
DISPLM$- Display Mode (string,input): Valid strings are "SCROLL", "PAGEC" (page clear), "PAGEO" (page overlay).
MINY - Minimum value of Y coordinate (real,input).
MAXY - Maximum value of Y coordinate (real,input).
MRM$ - Magnification/Reduction Mode (string,input): Valid strings are: "MAGNIFY" and "REDUCE".
RES% - Resolution (integer,input): Legal values from 1 to 100, or -1 (indicates that the graph will automatically be modified to fit a single window).
DEP1, DEP2 - Depth 1, Depth 2 (reals,input): Selects subsets from the sub-arrays specified by WIDL%; DEP1 determines the low depth index, DEP2 determines the high depth index.
EUF% - Engineering Units Flag (integer,input): See page 48.

Notes

Provides horizontal-linear graphing of data values stored in Soft500 array / Foreground

Timing

Approximate time to plot 1 analog point: 19 ms / Approximate analog graphing speed: 54 Hz / Time to auto-scale on 1000 analog data points: 7 sec

GRAPHRT — Graph Real-Time

CALL GRAPHRT' (BFN$, WIDL$, COLL$, DISPLM$, MINY, MAXY [,NPTS] [,EUF%])

BFN$ - Background Function Name (string,input): Name of the background function to be graphed.
WIDL$ - Width List (string,input): String consisting of widths to be graphed.
COLL$ - Color List (string,input): Legal values any integer from 0-3.
DISPLM$- Display Mode (string, input): Valid strings are "SCROLL", "PAGEC" (page clear), "PAGEO" (page overlay).
MINY - Minimum value of Y coordinate (real,input)
MAXY - Maximum value of Y coordinate (real,input).
NPTS - Number of Points (real,input): Legal values are ≥ 1, or -1 (graphs continuously).
EUF% - Engineering Units Flag (integer,input): See page 48.

Notes
Provides real-time graphing of one to several channels accessed by ANIN, ANOUT, DIGIN, DIGOUT, and FREQIN

Timing
Approximate time to plot 1 analog point (fast mode): 7ms / Approximate analog graphing speed: 140 Hz

CALL HALT' (BFNL$ [,TM$ [,BFN$]])

BFNL$ - Background Function Name List (string,input): List of 1-16 background function names.
TM$ - Trigger Mode (string,input): Valid strings for HALT are "WBT", "WGO".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Halts execution of up to 16 background tasks / Foreground or background / Tasks HALTed may not be resumed

CALL INIT (no parameters)

Notes
Initializes the Soft500 software / Singleground / Must be the first Soft500 command issued in any Soft500 program

INTEGRAL

CALL INTEGRAL' (ARN$, WID%, INTEG [,DEP1, DEP2] [,EUF%])

ARN$ - Array Name (string,input): Name of Soft500 array to be accessed.
WID% - Width (integer,input): Specifies the sub-array on which INTEGRAL executes.
INTEG - Inteyral (real,output): Area under the specified data curve.
DEP1, DEP2 - Depth 1, Depth 2 (reals,input): Selects a subset from the sub-array specified by WID%; DEP1 determines the low depth index, DEP2 determines the high depth index.
EUF% - Engineering Units Flag (integer,input): See page 48.

Notes

Returns the integral of a data curve between two specified points, using Simpson's rule of integration / Foreground

INTOFF

Interrupts Off

CALL INTOFF (no parameters)

Notes
Turns off Series 500 interrupts / Foreground

INTON — Interrupts On

CALL INTON' [(IR%, TU$)]

IR% - Interrupt Rate (integer,input): Range of legal values depends on string assigned Time Units parameter.
TU$ - Time Units (string,input): Specifies time units used in conjunction with IR%. Valid strings are: "MIL" (milliseconds), "SEC" (seconds), "MIN" (minutes).

Notes

Turns on Series 500 timer-generated interrupts / Singleground / When no parameters are used the interrupt period defaults to once every 10 milliseconds / Maximum values for IR%: 32767 ms
4400 sec
74 min

IONAME — Input/Output Name

CALL IONAME' (ION$, SLOT%, CHAN% or PORT$ [,ACC%] [,GA%] [,STRG%])

ION$ - Input Output Name (string,input): Up to 8 significant characters, no delimiters
SLOT% Slot (integer,input): Legal values are 1 to 10, and 0,13,14,15 (reference voltages).
CHAN% Channel (integer,input): Values 0 to 32 identify channels 0 to 32.
PORT$ - Port (string,input) Valid strings are "A" (channels 0-7), and "B" (channels 8-15).
ACC% - Accuracy (integer,input) Specifies accuracy of A/D converter. Assign 12 for 12-bit converter, 14 for 14-bit.
GA% - Gain (integer,input): Values 1,2,5,and 10 provide gains of x1, x2, x5, x10 respectively.
STRG% - Strain Gauge Gain (integer,input): Specifies gain applied to strain gauge signals connected to the AIM6 module Legal values include: 1 - gain of x50 for RTDs
2 - gain of x166.6 for +/-30mv strain gauges
3 - gain of x50 for +/-100mv strain gauges and AD590 and AC2626 devices

Notes

Associates a string with a particular channel of input or output / Foreground / All I/O channels must be named with IONAME before being accessed by Soft500 I/O commands.

LINREGR — Linear Regression

CALL LINREGR' (ARN$, WID1%, WID2%, M, B [,DET, CORR, STERR] [,DEP1, DEP2] [,EUF%])

ARN$	- Array Name (string,input): Name of Soft500 array to be accessed.
WID1%	- Width 1 (integer,input): Specifies set of data used to calculate x value in y=mx+b.
WID2%	- Width 2 (integer,input): Specifies set of data used to calculate y value in y=mx+b.
M	- Slope (real,output): Corresponds to m value in y=mx+b.
B	- Y-intercept (real,output): Corresponds to b value in y=mx+b.
DET	- Coefficient of Determination (real,output): Calculated by squaring the coefficient of correlation.
CORR	- Coefficient of Correlation (real,output).
STERR	- Standard Error of Estimate (real,output): The standard error of actual data values from regression.
DEP1, DEP2	- Depth 1, Depth 2 (reals,input): Selects subsets from the sub-arrays specified by WID1% and WID2%; DEP1 determines the low depth index, DEP2 determines the high depth index.
EUF%	- Engineering Units Flag (integer,input): See page 48.

Notes

Foreground / If WID1% is set to 0 the regression will be performed against time

MEANDEV Mean and Standard Deviation

CALL MEANDEV' (ARN$, WID%, MEAN, STDEV [,DEP1, DEP2] [,EUF%])

ARN$ - Array Name (string,input): Name of Soft500 array to be accessed.
WID% - Width (integer,input): Specifies the sub-array on which MEANDEV executes.
MEAN - Arithmetic Mean (string,output): The arithmetic mean of all data points in the sub-array.
STDEV - Standard Deviation (real,output): The standard deviation of the set of data points.
DEP1, DEP2 - Depth 1, Depth 2 (reals,input): Selects a subset from the sub-array specified by WID%; DEP1 determines the low depth index, DEP2 determines the high depth index.
EUF% - Engineering Units Flag (integer,input): See page 48.

Notes
Foreground

MEMFREE — Memory Free

CALL MEMFREE' (SIZE)

SIZE - Size (real,output): Size of largest block of contiguous memory available for data storage; value returned represents some number of bytes.

Notes

Returns the size of the largest free block of contiguous memory / Foreground / Since Soft500 allocates in blocks of 16K, the value returned to SIZE will always be a multiple of 16.

PAUSE

CALL PAUSE' (TIME%, TU$)

TIME% - Time (integer,input): Specifies number of time units to wait before continuing with foreground execution.
TU$ - Time Units (string,input): Specifies time units used by TIME%; valid strings are: "SEC" (seconds), "MIN" (minutes).

Notes

Singleground / Maximum values for TIME%: 50 minutes, 3000 seconds

PULSECOUNT — Pulse Count

CALL PULSECOUNT' (ION$, BINTV% [,MODE%] [,TM$] [,BFN$])

ION$ - Input/Output Name (string,input): Name of channel to be accessed; channel named with IONAME.
BINTV% - Background Interval (integer,input): Frequency of task execution in terms of the interrupt rate.
MODE% - Mode (integer,input): Defaults to normal pulse counting, 1 specifies gated pulse counting.
TM$ - Trigger Mode (string,input): Valid strings for PULSECOUNT are "WBT", "WGO".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Initiates pulse counting on PIM1 / Background / Single channel (or single gated pair) / Used in conjunction with COUNTERREAD

SCHMITRIG — Schmitt Trigger

CALL SCHMITRIG' (ION$, THRL, THRH, CHM$ [,EUF%] [,TM$ [,BFN$]])

ION$ - Input/Output Name (string,input): Name of channel to be monitored; channel named with IONAME.
THRL - Threshold Low (real,input): Value must be < value assigned THRH, and within converter range.
THRH - Threshold High (real,input): Value must be > value assigned THRL, and within converter range.
CHM$ - Change Mode (string,input): Specifies triggering condition of monitored signal, valid strings are: "ABOVE","BELOW","BETW","NOTBETW".
EUF% - Engineering Units Flag (integer,input): See page 48.
TM$ - Trigger Mode (string,input): Valid strings for SCHMITRIG are "ST", "BT".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Reads a single channel of analog input and determines whether the signal has met specified conditions / Foreground, Background or Singleground / Supports all AIM modules

Timing

Background trigger time: 0.405 ms
Time between threshold detection and initiation of triggered task: 129 usec (approx)
Singleground trigger polling speed: 2.272 Khz
Time between threshold detection and initiation of triggered task: 174 usec (approx)

CALL STATUS' (BFN$, STATUS%)

BFN$ - Background Function Name (string,input): Name of background task to be checked.
STATUS% - Status (integer,output): Value returned will be one of four integers:
0 = function is off or not found
1 = function is executing
2 = function is waiting for background trigger
3 = function is waiting for a GO command

Notes
Returns the current status of a specified background routine / Foreground

TIMERREAD — Timer Read

CALL TIMERREAD' (TIM0%, VAL0# [,TIM1%, VAL1#...,TIM7%, VAL7#] [,TM$ [,BFN$]])

TIMX% - Timer X (integer,input): Assign values 0-7 indicating which of 8 software timers are to be read.
VALX# - Value X (double precision real,output): VAL0# to VAL7# return the elapsed time (in terms of interrupt period) of software timers 0-7.
TM$ - Trigger Mode (string,input): Valid strings for TIMERREAD are "WBT", "WGO".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Reads up to 8 timers with one execution / Foreground / To find total elapsed time, multiply VALX# by the interrupt period.

TIMERSTART

Timer Start

CALL TIMERSTART' (TIM0% [,TIM1%..,TIM7%] [,TM$ [,BFN$]])

TIMX% - Timer X (integer,input): Values 0-7 indicate which of 8 software timers are to be started.
TM$ - Trigger Mode (string,input): Valid strings for TIMERSTART are "WBT", "WGO".
BFN$ - Background Function Name (string,input): Up to 8 significant characters, no delimiters.

Notes

Initializes any or all of the 8 Soft500 timers / Foreground

WARNOFF — Warnings Off

CALL WARNOFF (no parameters)

Notes
Turns off Soft500 warning error messages / Foreground

WARNON — Warnings On

CALL WARNON (no parameters)

Notes
Reactivates Soft500 warning error messages / Foreground

ENGINEERING UNITS CONVERSION TABLE

Transducers	EUF%	Modules Supported	Units	Voltage Ranges Supported	Interfacing Requirements
None	-1	AIM1 - 6 AOM1,2,3,4 PIM1	Raw	all	None, all gains supported
None	0	AIM1 - 6 AOM1,2,4	Raw→Volts Volts→Raw	all	None, all gains supported
Thermocouple J	10	AIM3,5	°C	all	Path-to-Ground Resistor required with AIM3
Thermocouple K	11	AIM3,5	°C	all	Path-to-Ground Resistor required with AIM3
Thermocouple S	12	AIM3,5	°C	all	Path-to-Ground Resistor required with AIM3
Thermocouple T	13	AIM3,5	°C	all	Path-to-Ground Resistor required with AIM3
Thermocouple E	14	AIM3,5	°C	all	Path-to-Ground Resistor required with AIM3
Thermocouple B	15	AIM3,5	°C	all	Path-to-Ground Resistor required with AIM3

Thermocouple R	16	AIM3,5	°C	all	Path-to-Ground Resistor required with AIM3
RTD alpha = 0.00385	20	AIM6	°C	±2.5V ±5.0V ±10.0V	IONAME must invoke RTD mode with local gain of x50
RTD alpha = 0.00392	21	AIM6	°C	±2.5V ±5.0V ±10.0V	IONAME must invoke RTD mode with local gain of x50
Strain Gage ±30mV	30	AIM6	-100 to +100%	±2.5V ±5.0V ±10.0V	IONAME must invoke Strain Gage mode with gain of x166
Strain Gage ±100mV	31	AIM6	-100 to +100%	±2.5V ±5.0V ±10.0V	IONAME must invoke Strain Gage mode with gain of x166
AD590/AC2626 Sensors	40	AIM1,3,5,6	°C	all	1000 ohm shunt resistor (220 for AIM6)
4-20 mA Current Loop Inputs	50	AIM1,2,3,4 AOM3	Raw→mA mA→Raw	0-5.0V ±10.0V 0-5.0V 0-10.0V	Local Gain of 1 with a 250 ohm shunt typical
None	60	PIM1	Hz	all	8mHz maximum frequency input

Notes

All engineering units conversions support both the ADM1 and ADM2 modules, for 12-bit and 14-bit accuracy, respectively.

SOFT500 RESERVED WORDS

"ABOVE"
"BELOW"
"BETW"
"BT"
"GRAPH"
"MAGNIFY"
"MIL"
"MIN"
"NOTBETW"
"OFF"
"ON"
"PAGEC"
"PAGEO"
"REDUCE"
"SCROLL"
"SEC"
"ST"
"WBT"
"WGO"
"WST"

COLOR LIST FOR COLL$ PARAMETER

Value	Palette 0	Palette 1
0	background color	background color
1	green	cyan
2	red	magenta
3	brown	white

SAMPLE PROGRAMS

Analog Input with Real-Time Graphing

The following program takes 200 samples of analog input from an AIM1 module (one sample every 100 milliseconds), stores those readings in an array named "Array1%", and graphs them on the screen of your monitor.

```
10 CALL INIT
20 CALL IONAME' ("VoltsIn", 1, 0, 12)
30 CALL INTON '(50, "Mil")
40 CALL ANIN' ("Array1%", 200., "VoltsIn", 2, "Test")
50 SCREEN 1
60 CALL GRAPHRT' ("Test", "1", "2", "Scroll", 0., 4095.0)
```

Soft500 Commands Used:

INIT (No Parameters)
IONAME' (ION$, SLOT%, CHAN% OR PORT$ [,ACC%][,GA%][,STRG%])
INTON ['(IR%, TU$)]
ANIN' (ARN$, SN, IONL$, BINTV% [,CY%][,TM$][,BFN$])
GRAPHRT' (BFN$, WIDL$, COLL$, DISPLM$, MINY, MAXY [,NPTS][,EUF%])

Line 10 - The Soft500 software is initialized.

Line 20 - The Input Output Name command associates a string "VoltsIn" with slot 1, channel 0 and the type of A/D converter (12 bit). The optional parameters, GA% and STRG% are not used.

Line 30 - The interrupt rate is set to 50, specifying that ANIN will check the "VoltsIn" signal every 50 milliseconds.

Line 40 - The Analog Input command names the array to be filled, "Array1%", and specifies that 200 samples are taken from the channel named "VoltsIn" once every second interrupt (i.e. once every 100 milliseconds). This background task is given the name "Test". The optional parameters, CY% and TM$ are not used.

Line 50 - The BASIC command SCREEN 1 sets the screen for the graphics mode.

Line 60 - The Graph Real-Time command finds the background task named "Test" and graphs the single width of data stored by ANIN (WIDL$=1). The COLL$ parameter is assigned the value 2, specifying that the data will be graphed in red. The DISPLM$ parameter specifies that the window will scroll to the left, and MINY and MAXY set the end points of the Y axis to 0 and 4095. The optional parameters, NPTS and EUF%, are not used.

Analog Output with BASIC polling

This program allows the user to output various voltages to specified output channels. Note that the program assumes that an analog output module is installed in slot 4 of the Series 500 baseboard.

```
10 CALL INIT
20 INPUT "OUTPUT CHANNEL", A%
30 INPUT "OUTPUT VOLTAGE", B
40 CALL IONAME' ("AnChan", 4, A%)
50 CALL ANWRITE' ("AnChan", B, 0)
60 GOTO 10
```

Soft500 commands used:

INIT (no parameters)
IONAME' (ION$, SLOT%, CHAN% OR PORT$ [,ACC%][,GA%][,STRG%])
ANWRITE' (ION$, VA [,EUF%][,TM$])

Line 10 - The Soft500 software is initialized.

Line 20 - The BASIC INPUT statement polls the user for the desired output channel. The range of legal values which can be entered depends on which analog output module is being used. The AOM1/5 module, for example, has five available channels: 0-4.

Line 30 - The BASIC INPUT statement polls the user for the desired output voltage. The range of legal voltages depends on the output range selected for the analog output channel being used.

Line 40 - The Input Output Name command associates the string "AnChan" with the channel designated in line 20 and with slot 4. The optional parameters, GA% and STRG% are not used.

Line 50 - The Analog Write command outputs the voltage specified in line 30 to the "AnChan" channel. Assigning 0 to the EUF% parameter indicates that value specified in line 30 was given in volts. The optional parameter TM$ is not used.

Line 60 - Directs the program back to line 10, allowing the user to differentiate voltage outputs and/or output channels.

A Simple SCHMITRIG

This program monitors a specified analog signal, repeatedly checking to determine if it has exceeded a 6.5 volt limit. If the limit is exceeded, a beep will sound and a warning message will appear on the screen.

```
10 CALL INIT
20 CALL IONAME' ("VoltsIn", 5, 0, 12)
30 CALL SCHMITRIG' ("VoltsIn", 0., 6.5, "ABOVE", 0)
40 BEEP
50 PRINT "VOLTAGE EXCEEDS LIMIT"
```

Soft500 Commands Used:

INIT (no parameters)
IONAME' (ION$, SLOT%, CHAN% OR PORT$ [,ACC%][,GA%][,STRG%])
INTON ['(IR%, TU$)]
SCHMITRIG' (ION$, THRL, THRH, CHM$ [,EUF%][,TM$][,BFN$])

Line 10 - The Soft500 software is initialized.

Line 20 - The Input Output Name command names the channel, "VoltsIn" and specifies that the signal is to be read from slot 5, channel 0, and routed through a 12 bit A/D converter. The optional parameters, GA% and STRG%, are not used.

Line 30 - The SCHMITRIG command monitors the "VoltsIn" channel, checking the signal level and determining its relationship to the low and high thresholds specified by THRL and THRH. In this example, THRL is assigned 0. and THRH 6.5, indicating that the acceptable voltage range is 0-6.5 volts. The CHM$ parameter is assigned the string "ABOVE", causing SCHMITRIG to suspend execution of the program, checking the signal until it exceeds the high threshold (6.5 volts). When the signal exceeds the limit, the SCHMITRIG task turns itself off, and the program continues. The optional parameters, TM$ and BFN$ are not used.

Line 40 - A BEEP is issued.

Line 50 - A warning message is printed on the screen. If the monitored signal never exceeds the 6.5 volt limit specified in line 30, then these lines will not be executed.

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